P-05

The surface analysis of the membranes with the different degree of cation-exchanger dispersity by AFM method

E.M. Akberova

FSBEE HE «Voronezh State University», 394018, Voronezh, Russia
e-mail: elmara_09@inbox.ru

At present, one of the directions in improvement of electromembrane methods of substances separation and isolation is the development of new membranes with optimized surface morphology, that allow to increase in the efficiency of electrodialysis in overlimiting current regimes due to the development of electroconvection. The purpose of this work is a comparative analysis of the surface microstructure of the experimental samples of membranes with different ion exchanger dispersity degrees by AFM method.

In the study there was evaluated the geometrical inhomogeneity of experimental samples of heterogeneous cation-exchange Ralex CM Pes membranes (MEGA a.s., Czech Republic) and commercially available MK-40 heterogeneous sulfocation-exchange membrane (LLC "IP Shchekinoazot", Russia). The Ralex membranes were obtained by rolling the homogenised mixture of milled ion-exchanger with varying dispersity degrees with polyethylene. The dispersity degree of sulfocation-exchanger was varied by using of time of its milling from 5 to 80 minutes. The AFM images of dry membrane samples were processed by means of the Nova RC1 software of a Solver P47 Pro microscope.

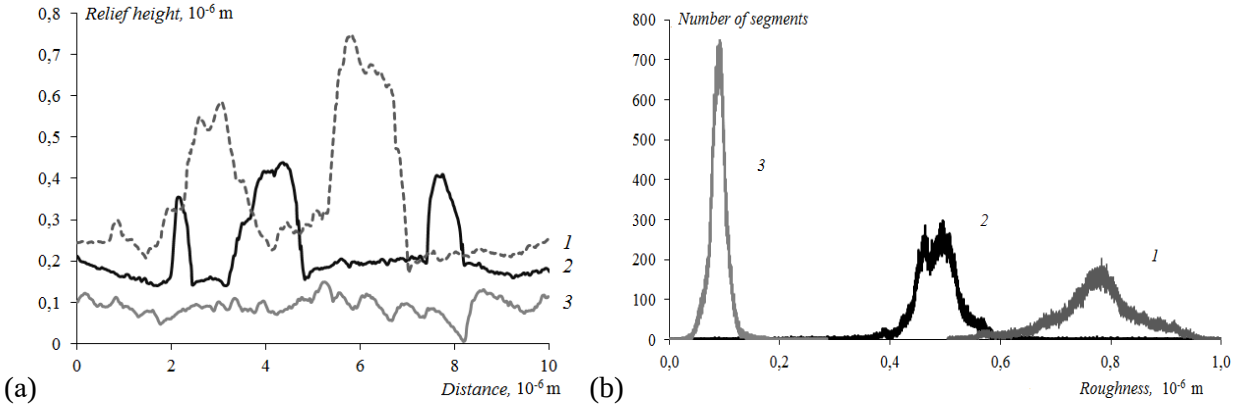

Figure 1. The microprofiles (a) and histograms of the density distribution of the heights for the entire image (b) of the samples of the MK-40 (1) and CM Pes membranes with the ion exchanger milling time of 5 (2) and 80 (3) min. Scanning area of 10 × 10 μm.

A comparison of the surface microrelief and histograms of heights distribution on the surface of the experimental CM Pes and MK-40 heterogeneous cation exchange membranes in the dry state is shown in Fig. 1a. The membrane with a higher degree of ion exchanger dispersity that appropriate milling time 80 min was characterized by a smoother surface on a micrometric scale: the maximum height R_y and the average arithmetic roughness R_a were 286 nm and 12 nm, respectively. Wherein, the maximum density distribution of the heights on the entire surface of the membrane sample was 0.1 μm (Fig. 1b). The microprofile of the membrane containing the ion exchange particles after 5 minutes of milling had the appearance of a more developed chaotic structure with an average roughness scale R_a twice as large. The maximum of density of the height distribution corresponded to a region of 0.4-0.6 μm. For the MK-40 membrane, which characterized by smaller degree of ion exchanger dispersity, the most pronounced surface relief, a significant asymmetry in the distribution of heights and a shift in the distribution toward higher values are revealed.

The work is supported by the grant of the President of Russian Federation MK-925.2018.3.

The author is grateful to the «MEGA» a.s. company (Czech Republic) and its owner Mr. L. Novak for providing experimental samples of the Ralex CM Pes sulfocation-exchange membranes.

AFM-data of the membranes surface were obtained at the CCUSE of VSU.